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IN THE U.S. PATENT AND TRADEMARK OFFICE

APPLICANT: Shoichi OSADA et al.  
SERIAL NO.: 09/883,276  
FILED: June 19, 2001  
FOR: Semiconductor Encapsulating Epoxy  
Resin Composition and Semiconductor  
Device  
GROUP: 1712  
EXAMINER: ZIMMER, MARC S

D E C L A R A T I O N

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Sir,

I, Shoichi OSADA, resident of c/o  
Silicone-Electronics Materials Research Center,  
Shin-Etsu Chemical Co., Ltd., 1-10, Oaza Hitomi,  
Matsuida-machi, Usui-gun, Gunma-ken, Japan do hereby  
declare that:

1. I was graduated from Master Course of Department of Material Science, Graduate School of Engineering, Tohoku University, Japan in March 1996. Since April 1996, I have been employed by Shin-Etsu Chemical Co., Ltd., the assignee of the above-identified application. I have been engaged in research and development relating to epoxy molding compound in the laboratory of the Company.

2. I am one of the named inventors of the above-identified application and hence, am familiar with the subject matter disclosed in said application.

3. In order to show the feature of the present invention, I conducted the following experiments.

[Experiment]

Epoxy resin compositions for semiconductor encapsulation were prepared by uniformly melt mixing the components shown in Table 1 in a hot twin-roll mill, followed by cooling and grinding.

Properties of these compositions were measured by the same method as in Example of the present specification.

Table 1

Component (pbw)	Example	Comparison	
	1	1	2
Epoxy resin (a)*	57.6	57.6	68.6
Curing agent (b)*	21.2	21.2	0
Curing agent (f)*	21.2	21.2	31.4
Nitrogen content**	1.7	1.7	0
Inorganic filler	500	500	500
Curing accelerator	1.2	1.2	1.2
KEMGARD 1261	50	-	50
Net amount of zinc molybdate from flame retardant	9	-	9
Antimony trioxide	-	-	-
Brominated novolac epoxy resin	-	-	-
Parting agent	3	3	3
Carbon black	2	2	2
Silane coupling agent	1	1	1

\* The molar ratio of epoxy groups and phenolic hydroxy groups in the epoxy resin compositions of Example 1 and Comparisons 1 and 2 is 1.0, respectively.

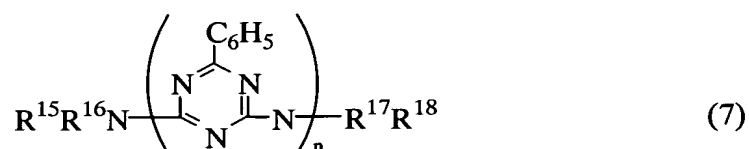
\*\* The content of nitrogen atoms contained in the entire composition is expressed in percent by weight based on the weight of epoxy resin (A) and phenolic resin curing agent (B) combined.

Epoxy resin (a):

o-cresol novolac epoxy resin: EOCN 1020-55 by Nippon Kayaku K.K. (epoxy equivalent 200)

Curing agent (b):

phenol novolac resin having benzoguanamine skeleton represented by formula (7) (nitrogen atom content 8 wt%, softening point 94°C, phenolic hydroxyl equivalent 130)



In formula (7),  $R^{15}$ ,  $R^{16}$ ,  $R^{17}$ , and  $R^{18}$  are hydrogen or a phenol novolac resin having one free valence bond, with the proviso that at least one of  $R^{15}$ ,  $R^{16}$ ,  $R^{17}$ , and  $R^{18}$  is a phenol novolac resin having one free valence bond, and  $n$  is an integer of 1 to 10 selected so as to give the phenolic hydroxyl equivalent of (b) and (c).

Curing agent (f):

phenol novolac resin DL-92 by Meiwa Kasei K.K. (hydroxyl equivalent 110)

KEMGARD 1260:

Zinc molybdate on inorganic filler (zinc molybdate content 18 wt%, inorganic filler: spherical silica with a mean particle size  $0.5\ \mu\text{m}$  and a specific surface area  $5.5\ \text{m}^2/\text{g}$ ) by Sherwin-Williams Co.

Inorganic filler:

Spherical fused silica (mean particle size  $15\ \mu\text{m}$ ) by Tatsumori K.K.

Curing accelerator:

triphenyl phosphine by Hokko Chemical K.K.

Parting agent:

Carnauba wax by Nikko Fine Products K.K.

Silane coupling agent:

KBM403 ( $\gamma$ -glycidoxypropyltrimethoxysilane) by Shin-Etsu Chemical Co., Ltd.

Table 2

	Example	Comparison	
	1	1	2
Spiral flow (cm)	70	90	70
Moldability	OK	OK	OK
Hardness when molded	75	80	75
Flame retardance	V-0	burned	burned
High-temperature capability	0/20	0/20	0/20

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated this *24<sup>th</sup>* day of *June* , 2003

*Shoichi Akita*